Fire – Weather

This document describes general weather observations for wildland and prescribed fires including ambient air temperature, relative humidity, and wind speed and direction. For detailed protocols, refer to Fischer and Hardy 1976, and Finklin and Fischer 1990. This protocol was developed for the National Park Service's (NPS) fire monitoring program but may be adapted for other monitoring purposes. For background information on the fire monitoring program, including the purpose and overview of the program, related policy, and personnel responsibilities, refer to Chapter 1, pages 1-5 of the NPS Fire Monitoring Handbook (FMH, http://www.nps.gov/fire/fmh/FEMHandbook.pdf). An overview of management objectives and the process for developing corresponding monitoring program objectives is reviewed in Chapter 3, pages 19-32 of the FMH.

Sampling design, including defining the population of interest, pilot sampling, calculating minimum sample size, and addressing potential design problems, is described in FMH Chapter 4, pages 33-54. Methods for generating and selecting plot locations and installing plots are found in FMH Chapter 5, pages 59-79. The schedule for monitoring prior to and following fire treatment is located in FMH Chapter 5, pages 55-58, although the schedule may be revised for other purposes. For a list of field equipment needs recommended for implementing this protocol, see FMH Appendix E, pages 221-224.

Information about monitoring program file maintenance and data storage is found in FMH Chapter 5, pages 112-113. To review data quality procedures, see FMH Chapter 5, pages 114-117.

The field methods for the protocol described below are taken from FMH Chapter 2, pages 11-12 (http://www.nps.gov/fire/fmh/FEMHandbook.pdf). Specific forms developed for field data collection follow the protocol description.

Fire Conditions Monitoring

The second portion of level 2 monitoring documents fire conditions. Data on the following variables can be collected for all fires. Your park's fire management staff should select appropriate variables, establish frequencies for their collection, and document these standards in your burn plan or Wildland Fire Implementation Plan–Stage II: Short-term Implementation Action and Wildland Fire Implementation Plan–Stage III: Long-term Implementation Actions.

- Topographic Variables
- Ambient Conditions
- Fuel Model
- Fire Characteristics
- Smoke Characteristics
- Holding Options
- Resource Advisor Concerns

MONITORING SCHEDULE

The frequency of Fire Conditions monitoring will vary by management strategy and incident command needs. Recommended Standards are given below.

PROCEDURES AND TECHNIQUES

Collect data from aerial or ground reconnaissance and record them in the Wildland Fire Implementation Plan. These procedures may include the use of forms FMH-1, -2, and -3 (Appendix A). Topographic variables, ambient condition inputs, and fire behavior prediction outputs must follow standard formats for the Fire Behavior Prediction System (Albini 1976; Rothermel 1983). **For specific concerns on conducting fire conditions monitoring during a prescribed fire in conjunction with fire effects monitoring plots, see page 106.**

Collect data on the following fire condition (RS) variables:

Topographic Variables

Slope
Measure percent slope using a clinometer (for directions on using a clinometer, see page 203). Report in percent. A common mistake is to measure the slope in degrees and then forget to convert to percent; a 45° angle is equal to a 100% slope (see Table 34, page 211 for a conversion table).

Aspect
Determine aspect. Report it in compass directions, e.g., 270° (for directions on using a compass, see page 201).

Elevation
Determine the elevation of the areas that have burned. Elevation can be measured in feet or meters.

Ambient Conditions

Ambient conditions include all fire weather variables. You may monitor ambient weather observations with a Remote Automatic Weather Station (RAWS), a standard manual weather station, or a belt weather kit. More specific information on standard methods for monitoring weather can be found in Fischer and Hardy (1976) or Finklin and Fischer (1990). Make onsite fire weather observations as specified in the Fire-Weather Observers' Handbook (Fischer and Hardy 1976) and record them on the Onsite weather data sheet (form FMH-1) and/or the Fire behavior–weather data sheet (FMH-2). Samples of these forms are in Appendix A.

Fuel moisture may be measured with a drying oven (preferred), a COMPUTRAC, or a moisture probe, or may be calculated using the Fire Behavior Prediction System (BEHAVE) (Burgan and Rothermel 1984). Record in percent.

Dry bulb temperature
Take this measurement in a shady area, out of the influence of the fire and its smoke. You can measure temperature with a thermometer (belt weather kit) or hygrothermograph (manual or automated weather station), and record it in degrees Fahrenheit or degrees Celsius (see Table 33, page 209 for conversion factors).

Relative humidity
Measure relative humidity out of the influence of the fire using a sling psychrometer or hygrothermograph at a manual or automated weather station. Record in percent.

Wind speed
Measure wind speed at eye level using a two-minute average. Fire weather monitoring requires, at a minimum, measurement of wind speed at a 20 ft height, using either a manual or automated fire weather station. Record wind speed in miles/hour, kilometers/

hour, or meters/second (see Table 33, page 209 for conversion factors).

Wind direction
Determine the wind direction as the cardinal point (N, NE, E, SE, S, SW, W, or NW) from which the wind is blowing. Record wind direction by azimuth and relative to topography, e.g., 90° and across slope, 180° and upslope.

Shading and cloud cover
Determine the combined cloud and canopy cover as the fire moves across the fire area. Record in percent.

Timelag fuel moisture (10–hr)
Weigh 10-hr timelag fuel moisture (TLFM) sticks at a standard weather station or onsite. Another option is to take the measurement from an automated weather station with a 10-hr TLFM sensor. If neither of these methods is available, calculate the 10-hr TLFM from the 1-hr TLFM—which is calculated from dry bulb temperature, relative humidity, and shading. Record in percent.

Timelag fuel moisture (1-, 100-, 1000-hr)
If required for fire behavior prediction in the primary fuel models affected, measure 1-hr, 100-hr, and 1000-hr TLFM as well, in the same manner as 10-hr using an appropriate method. If you decide to determine fuel moisture by collecting samples, use the following guidelines:

- Collect most of your samples from positions and locations typical for that type of fuel, including extremes of moistness and dryness to get a suitable range.
- Take clear concise notes as to container identification, sample location, fuel type, etc.
- Use drafting (not masking or electrical) tape or a tight stopper to create a tight seal on the container. Keep samples cool and shaded while transporting them.
- Carefully calibrate your scale.
- Weigh your samples as soon as possible. Weigh them with the lid removed, but place the lid on the scale as well. If you cannot weigh them right away, refrigerate or freeze them.
- Dry your samples at 100° C for 18–24 hours.
- Remove containers from the oven one at a time as you weigh them, as dried samples take up water quickly.
- Reweigh each dried sample.
- Use the formula on page 215 to calculate the moisture content.

You can find further advice on fuel moisture sampling in two publications written on the subject (Countryman and Dean 1979; Norum and Miller 1984); while they were designed for specific geographic regions, the principles can be applied to other parts of the country.

Live fuel moisture
Fuel models may also require measurement of woody or herbaceous fuel moisture. Follow the sampling guidelines described under "Timelag fuel moisture (1-, 100-, 1000-hr)" on page 12. Live fuel moisture is measured in percent.

Drought index
Calculate the drought index as defined in your park's Fire Management Plan. Common drought indices are the Energy Release Component (ERC) or the Keetch-Byram Drought Index (KBDI). Other useful indices are the Palmer Drought Severity Index (PDSI) and the Standardized Precipitation Index (SPI).

Duff moisture (optional)
Monitor duff moisture when there is a management concern about burn severity or root or cambial mortality. Duff moisture affects the depth of the burn, resonance time and smoke production. Measure duff samples as described above for Timelag fuel moisture (1-, 100-, 1000-hr). Duff moisture is measured in percent.

Duff Moisture

Duff moisture can be critical in determining whether fire monitoring plots are true replicates, or they are sampling different treatments. It is assumed that if plots within a monitoring type identified in a five-year burn plan are burned with the same fire prescription, they are subject to the same treatment. These plots should only be considered to have been treated the same if the site moisture regimes, as influenced by long term drying, were similar. Similar weather but a different site moisture regime can result in significant variation in postfire effects, which can be extremely difficult to interpret without documentation of moisture. This is particularly important when studying prescribed fires.

State of the weather (optional)
Monitor state of the weather when there is a management recommendation for this information. Use a one-digit number to describe the weather at the time

of the observation. 0-clear, less than 10% cloud cover; 1-scattered clouds, 10–50% cloud cover; 2-broken clouds; 60–90% cloud cover; 3-overcast, 100% cloud cover; 4-fog; 5-drizzle or mist; 6-rain; 7-snow; 8-showers; 9-thunderstorms.

Only use state of the weather code 8 when showers (brief, but heavy) are in sight or occurring at your location. Record thunderstorms in progress (lightning seen or thunder heard) if you have unrestricted visibility (i.e., lookouts) and the storm activity is not more than 30 miles away. State of the weather codes 5, 6, or 7 (i.e., drizzle, rain, or snow) causes key NFDRS components and indexes to be set to zero because generalized precipitation over the entire forecast area is assumed. State of weather codes 8 and 9 assume localized precipitation and will not cause key NFDRS components and indexes to be set to zero.

Fuel Model

Determine the primary fuel models of the plant associations that are burning in the active flaming front and will burn as the fire continues to spread. Use the Fire Behavior Prediction System fuel models #1–13 (Anderson 1982) or create custom models using BEHAVE (Burgan and Rothermel 1984).

Fireline Safety

If it would be unsafe to stand close to the flame front to observe ROS, you can place timing devices or firecrackers at known intervals, and time the fire as it triggers these devices.

Where observations are not possible near the monitoring plot, and mechanical techniques such as firecrackers or in-place timers are unavailable, establish alternate fire behavior monitoring areas near the burn perimeter. Keep in mind that these substitute observation intervals must be burned free of side-effects caused by the ignition source or pattern.

Fire Characteristics

For specific concerns on monitoring fire characteristics during a prescribed fire in conjunction with fire effects monitoring plots, see page 106. Collect data on the following fire characteristics (RS):

Rate of spread

Rate of Spread (ROS) describes the fire progression across a horizontal distance; it is measured as the time it takes the leading edge of the flaming front to travel a given distance. In this handbook, ROS is expressed in chains/hour, but it can also be recorded as meters per second (see Table 33, page 209 for conversion factors).

Make your observations only after the flaming front has reached a steady state and is no longer influenced by adjacent ignitions. Use a stopwatch to measure the time elapsed during spread. The selection of an appropriate marker, used to determine horizontal distance, is dependent on the expected ROS. Pin flags, rebar, trees, large shrubs, rocks, etc., can all be used as markers. Markers should be spaced such that the fire will travel the observed distance in approximately 10 minutes.

If the burn is very large and can be seen from a good vantage point, changes in the burn perimeter can be used to calculate area ROS. If smoke is obscuring your view, try using firecrackers, or taking photos using black-and-white infrared film. Video cameras can also be helpful, and with a computerized image analysis system also can be used to accurately measure ROS, flame length, and flame depth (McMahon and others 1987).

Perimeter or area growth

Map the perimeter of the fire and calculate the perimeter and area growth depending upon your park's situational needs. As appropriate (or as required by your park's Periodic Fire Assessment), map the fire perimeter and calculate the area growth. It's a good idea to include a progression map and legend with the final documentation.

Flame length

Flame length is the distance between the flame tip and the midpoint of the flame depth at the base of the flame—generally the ground surface, or the surface of the remaining fuel (see Figure 1, next page). Flame length is described as an average of this measurement as taken at several points. Estimate flame length to the nearest inch if length is less than 1 ft, the nearest half foot if between 1 and 4 ft, the nearest foot if between 4 and 15 ft, and the nearest 5 ft if more than 15 ft long. Flame length can also be measured in meters.

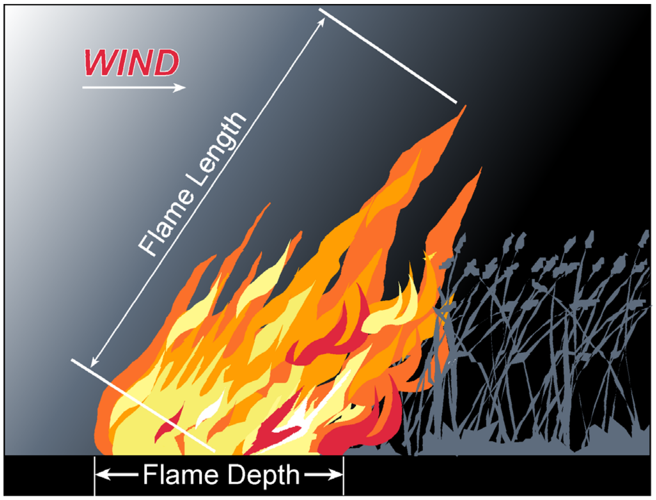

Figure 1. Graphical representation of flame length and depth.

Fire spread direction

The fire spread direction is the direction of movement of that portion of the fire under observation or being projected. The fire front can be described as a head (H), backing (B), or flanking (F) fire.

Flame depth (optional)

Flame depth is the width, measured in inches, feet or meters, of the flaming front (see Figure 1). Monitor flame depth if there is a management interest in residence time. Measure the depth of the flaming front by visual estimation.

Smoke Characteristics

These Recommended Standards for smoke monitoring variables are accompanied by recommended thresholds for change in operations following periods of smoke exposure (Table 2, page 17). **These thresholds are not absolutes, and are provided only as guidelines.** The following smoke and visibility monitoring variables may be recorded on the "Smoke monitoring data sheet" (FMH-3 or -3A) in Appendix A.

Visibility

This is an important measurement for several reasons. The density of smoke not only affects the health of those working on the line but also can cause serious highway concerns. Knowing the visibility will help law enforcement personnel decide what traffic speed is safe for the present conditions, and help fire management personnel decide the exposure time for firefighters on the line.

Visibility is monitored by a measured or estimated change in visual clarity of an identified target a known distance away. Visibility is ocularly estimated in feet, meters or miles.

Particulates

Park fire management plans, other park management plans, or the local air quality office may require measurement of particulates in order to comply with federal, state, or county regulations (see Table 2, page 17). The current fine particulate diameter monitoring standards are PM-2.5 and PM-10, or suspended atmospheric particulates less than 2.5 (or 10) microns in diameter.

Total smoke production

Again, measurement of total smoke production may be required by your fire management plan, other park management plans, or the local air quality office to comply with federal, state, or county regulations. Use smoke particle size–intensity equations, or an accepted smoke model to calculate total smoke production from total fuel consumed or estimates of intensity. Record in tons (or kilograms) per unit time.

Mixing height

This measurement of the height at which vertical mixing occurs may be obtained from spot weather forecast, mobile weather units, onsite soundings, or visual estimates. The minimum threshold for this variable is 1500 ft above the elevation of the burn block.

Transport wind speeds and direction

These measurements also can be obtained from spot weather forecasts, mobile weather units, or onsite soundings. The minimum threshold for this variable is 5 to 7 mph at 1500 ft above the elevation of the burn block.

Ground wind speeds and direction

See wind speed and direction on page 11.

Documented complaints from downwind areas

Your local air quality office will forward any written or verbal complaints to your park headquarters. The maximum allowable number of "recordable" complaints per treatment is defined by each air quality office.

Carbon monoxide (optional)

You can measure carbon monoxide on the fireline using a badge sampler or dosimeter (Reinhardt and others 2000), or by extrapolating from visibility measurements. Burn crew-members should not be exposed to areas of <100 ft visibility any longer than two hours.

Observer location and elevation (optional)
Recording the location and elevation of the observer can be important, as your view can be affected by your position. For example, visibility at 1,000 m may be fairly clear, but down at 500 m an inversion may be trapping smoke, and thus causing a greater concern to people living at that elevation. If you don't include the fact that your observation was made above that zone, it may appear that your records are inaccurate. Naturally, if you can see the inversion below you, and can approximate its ceiling, that should also be reported. Elevation can be recorded in feet or meters.

Elevation of smoke column above ground (optional)
The elevation of the top of the smoke column should be recorded in feet or meters above ground level. Features such as nearby mountains of known heights can be useful in making such an estimate.

Smoke column direction (optional)
The direction in which the column is pointed can be important, as this will help to predict possible smoke concerns downwind. Noting any breaks or bends in the column can also help predict possible spot fire conditions that may result.

Smoke inversion layer elevation (optional)
Information on inversion layers is critical to air quality and fire behavior management. Again, the top of the layer should be reported in feet or meters above the ground. Inversions can be identified by dark, "heavy" bands of air that are obviously clouded by smoke. Very often, this dense air will have an abrupt ceiling to it, above which the air is clear. Objects of known height can help you to accurately estimate the elevation of that inversion layer.

Smoke column (optional)
It may be pertinent to describe the characteristics of the smoke column. Is the column bent or leaning in a particular direction, or does it rise straight up for several thousand feet? Is it sheared, and if so, at what height? What color is the column? All of this information will help to quantify how the fire was burning and under what atmospheric conditions. Using the guide on the back of FMH-3A, describe the observed smoke column characteristics and atmospheric conditions.

Use of the Smoke monitoring data sheet (FMH-3)
The Smoke monitoring data sheet (FMH-3, in Appendix A) is intended for use on both wildland and prescribed fires. Each box on the data sheet is divided in two; place the time of your observation in the top portion of the box, and the observation value in the lower portion of the box. When you use this form, it is important to note the following:

- Formulas for determining appropriate highway visibilities (variable #2 on the form) can be found in the RX-450 Training Manual (NWCG 1997).
- Monitor the number of public complaints (monitoring variable #4) by time interval (two to four hours post-ignition), rather than at any specific time. "Recordable complaints" can be monitored via the local air quality office, park information desk or telephone operator.
- The monitoring frequency for surface winds (variable #8) should be determined by each park since this parameter is a frequent and critical source of data collection. At a minimum, however, collect these data once every 24 hours. Record monitoring frequencies along with wind speed in miles per hour (mph) or meters/sec (m/s) (see Table 33, page 209 for conversion factors).
- The formula for computing total emissions production (TEP) is found on the back of the FMH-3 form. TEP, in tons/acre is recorded under "OTHER," line 1. You can derive the emission factors included in this formula from factors available in the RX-450 training manual (NWCG 1997).

Holding Options
Identify areas or features that will slow the spread of the fire. Also identify vegetative conditions that provide for rapid fireline construction, should that become the appropriate management response.

Resource Advisor Concerns
The Resource Advisor may indicate specific variables that need to be observed as part of the monitoring process. This might include fire behavior upon contact with certain species, disturbance of wildlife, fire management impacts, etc.

Fire severity mapping (optional)
The postburn effects of a large fire are numerous and may include plant mortality, mud slides, and flooding. A quick assessment of the ecosystem can help you determine whether rehabilitation measures are needed. Managers may use this assessment to understand future patterns of vegetation and faunal distribution.

One critical step in this analysis is burn severity mapping. This type of survey can be done using any of several methods, including data from LANDSAT (White and others 1996), or from digital cameras (Hardwick and others 1997). For more specific information see the Burned Area Emergency Handbook (USDA Forest Service 1995), or call your regional or national BAER coordinator.

POSTBURN REPORT

Fire managers often need a summary of information immediately following a fire. While detailed information on fire effects are not immediately available, detailed information regarding fire observations and fire conditions can and should be summarized soon after the fire. This information may be used to refine prescriptions, strategy, and tactics over both the short and long term. **Decide in advance who is responsible for preparing this report.** A fire monitor can collect most of the information recommended. Consultation with the Burn Boss or Incident Commander is recommended.

Currently there is no standardized format for post burn reporting; the following list contains items to consider including in this report.

- Fire name
- Resource numbers and type (personnel and equipment)
- Burn objectives
- Ignition type and pattern
- Holding strategy
- Fuel moisture information (e.g., 1000-hr, live woody and herbaceous, foliar)
- Drought index information
- Fire behavior indices information (e.g., ERC)
- Precipitation information
- Test burn description
- Chronology of ignition
- Chronology of fire behavior
- Chronology of significant events
- Chronology of smoke movement and dispersal
- Temperature (range, minimum and maximum)
- Relative humidity (range, minimum and maximum)
- Accuracy of spot weather forecast
- Initial qualitative assessment of results (were short-term objectives achieved?)
- Future monitoring plan for area (e.g., plots, photo points)
- Acres burned
- Additional comments

Attachments:

- Map of area burned
- Fire weather observations data sheets
- Fire behavior observations data sheets
- Smoke observations data sheets
- Weather station data
- Fire severity map

Table 2. Smoke monitoring variables (RS) with techniques, frequencies, and recommended thresholds.

Variable	Location	Technique	Frequency	Threshold
Visibility: Duration of impairment by distance	Fireline	• Visual estimate	30 minutes	Exposure of burn crew-members to areas of <100 ft visibility not to exceed 2 hours
	Vicinity of fire (highways, concessions, residential areas, schools, etc.)	• Visual estimate	30 minutes	Exposure dependent on state Minimum Acceptable Visibility (MAV) standards
Duration of impairment by distance; no. people and sensitive areas affected	Downwind	• Visual estimate using known milestones or photographic standards	2 hours	Pop. — Min. distance (miles) 1K–5K — 2–5 >5K–50K — 4–7 >50K — 7–9
Particulates: PM-2.5/10; amount and duration[1]	Fireline, population centers and critical areas where smoke contribution is presumed to be significant	• PM-2.5/10 sampler • Established state and agency monitoring programs	24 hours/Annual	PM-2.5 — PM-10 $65 \mu g/m^3$ — $150 \mu g/m^3$ $15 \mu g/m^3$ — $50 \mu g/m^3$
Total Smoke Production: Tons (kilograms)/ unit time	Burn site or office	• Calculated from total fuel consumed • Intensity estimate • Smoke particle size–intensity equations	Preburn estimate followed by postburn reaffirmation	May be determined by state or local permit
Mixing Height: Height-Temperature Gradient	Ground	• Spot weather forecast • Mobile weather unit • Onsite sounding • Visual estimate	1 hour	1500 ft above burn elevation; do not violate for more than 3 h or past 1500 hours
Transport Winds: Speed	Burn site	• Spot weather forecast • Mobile weather unit • Onsite sounding	1 hour	5 to 7 mph at 1500 ft above burn elevation; do not violate for more than 3 hours or past 1500 hours
Ground Winds: Speed	Ground	• Wind gauge held at eye level • Mobile weather unit	1 to 6 hours (depending upon threat to safety and proximity of roads)	1 to 3 mph—day 3 to 5 mph—night
Complaints: Number	Received at headquarters or from an air quality resource district	• Written • Verbal	NA	The maximum allowable number of "recordable" complaints per treatment, as defined by the local air quality control district.
CO Exposure: ppm or duration of visibility impairment	Fireline	• Badge sampler or extrapolation with visibility • Dosimeter	30 minutes	Exposure of burn crew members to areas of <100 ft visibility not to exceed 2h. If exceeded, 24 hour detoxification is required before crew members can return to fireline duty

[1]PM-2.5 and PM-10 monitoring is mandatory only if a critical target exists within park boundaries or within 5 miles of a park boundary, and may be impacted by smoke of unknown quantities. The controlling air quality district may provide a PM-2.5 or PM-10 monitor in the surrounding area under any circumstances. The key is that the air quality district has the ultimate authority for determining when particulate matter standards are violated and when land managers must take appropriate actions to comply with established district, state and federal standards. A variety of occupational exposure limits exist, ranging from the OSHA Permissible Exposure limits to the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold limit values and the NIOSH Recommended Exposure Limits.

Additional Information for Monitoring Fire Behavior Characteristics

Collecting Fire Behavior and Weather Data

Previous editions of the Fire Monitoring Handbook (USDI NPS 1992) recommended that monitors record fire weather and behavior characteristics at each plot using Fire Behavior Observation Circles (FBOC) or Intervals (FBOI). The revised recommendations follow.

For the monitoring plots to be representative, they must burn under the same conditions and ignition techniques used in the rest of the prescribed fire block. **Fire monitor safety, however, must always be foremost.**

Forest monitoring types may include a dense understory layer, while brush and grassland fuel types are usually flashy; all of them may be unsafe to move through during a fire. The monitoring procedure presented here is an ideal and will be impossible to implement in some situations. The objective of monitoring fire characteristics in forest, brush or grassland types, therefore, is to do whatever is necessary to be safe while simultaneously obtaining representative fire behavior measurements wherever possible.

Take fire weather and behavior observations (rate of spread, flame length, and flame depth (optional), and other level 2 variables described in Chapter 2) in the same monitoring types represented by your plots, in an area where the fire behavior is representative of fire behavior on the plots. Where safe, you can make fire behavior observations near a monitoring plot.

Fire Behavior Accuracy Standards

Accuracy standards for each variable discussed in this section are listed in Table 29, page 111.

RATE OF SPREAD

To estimate Rate of Spread (ROS), you can use a Fire Behavior Observation Interval (FBOI). An FBOI consists of two markers placed a known distance apart, perpendicular to the flame front. Five feet is a standard length for the FBOI; however, you may shorten or lengthen the FBOI to accommodate a slower or faster moving flame front.

If you expect an irregular flaming front, set up another FBOI, perpendicular to the first FBOI. That way you will be prepared to observe fire behavior from several directions. If the fire moves along either FBOI, or diagonally, you can calculate ROS, because several intervals of known length are available. To distribute the FBOIs, use a setup that you think makes sense for your situation.

As the fire burns across each FBOI, monitor the recommended Fire Conditions (level 2) variables, and record observations on the Fire behavior–weather data sheet (FMH-2, in Appendix A). The time required for the fire to travel from one marker to the other divided by the distance (5 ft) is recorded as the observed rate of spread. For further information on ROS, see page 13.

Rate of Spread

You may use metric intervals to measure ROS. However, a possible problem with using metric ROS intervals is that you may forget to convert the metric into English units to get a standard linear expression for ROS, which is chains per hour or feet per minute. To avoid potential errors, it may be better to pre-measure and mark the ROS intervals in feet.

FLAME LENGTH AND DEPTH

During the fire, estimate flame length (FL) and flame depth (FD; optional) (see page 13) at 30-second intervals (or more frequently if the fire is moving rapidly), as the flaming front moves across the ROS observation interval. Use the Fire behavior–weather data sheet (FMH-2) to record data. If possible, make five to ten observations of FL and FD per interval. **Note:** Where close observations are not possible, use the height (for FL) or depth (for FD) of a known object between the observer and the fire behavior observation interval to estimate average flame length or flame depth.

Fire weather observations should be recorded at 30-minute intervals. Sample more frequently if you detect a change in wind speed or direction, or if the air temperature or relative humidity seems to be changing significantly, or if directed to do so by the prescribed burn boss.

Fireline Safety

- For safety, inform all burn personnel at the preburn briefing that the unit contains monitoring plots. It is recommended that you provide a brief discussion on the value of these plots, and your role on the burn.
- Inform all ignition personnel that they are to burn as if the plots do not exist. This will help avoid biased data, e.g., running a backing fire through a plot while using head fires on the rest of the unit.

Park/Unit 4-Character Alpha Code: ___________

FMH-1 **ONSITE WEATHER DATA SHEET** Page ___ of ____

Plot ID: ______________________________

Burn Status (Indicate number of times treated, e.g., 01 Burn, 02 Burn, etc.): ________-Burn

Burn Unit/Fire Name–Number: __________________________ Recorder(s): ________________

Circle Units for: Wind Speed (mph, m/s) Dry Bulb Temperature (°F, °C)

Obs. Date	Obs. Time	Wind Speed	Wind Dir.	D. B. (°)	R. H. (%)	Location / Comments

Date Entered: ____/____/____

Park/Unit 4-Character Alpha Code: ________________

FMH-1A **ALTERNATE ONSITE WEATHER DATA SHEET** Page _____ of _____

Plot ID: ____________________________ Burn Status (Indicate number of times treated, e.g., 01 Burn, 02 Burn, etc.): ________-Burn

Burn Unit/Fire Name–Number: ___________________________________ Recorder(s): ____

Circle Units for: Wind Speed (mph, m/s) Dry Bulb Temperature (°F, °C)

Date	Time	Location	Elevation	Aspect	*State of WX	Temperature Dry Bulb	Temperature Wet Bulb	RH	Wind Speed	Wind Direction	**Comments

*Codes State of the Weather:	0-clear, <10% cloud cover	1-10–50% cloud cover		**Comments include:
2-broken clouds, 60–90% cloud cover	4-fog	6-rain	8-showers	- ppt amount/duration
3-overcast, 100% cloud cover	5-drizzle or mist	7-snow or sleet	9-thunder-storm	- erratic winds

 Date Entered: ____/____/____